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Conference Abstract

FAIRification and AI-Readiness for Biodiversity Digital Twins

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Abstract

The European Green Deal addresses a wide array of critical topics regarding the interaction and exchange between society and ecosystems involving human-induced climate change, biodiversity loss, and deforestation. To support the development of appropriate and sustainable mitigation strategies, both political frameworks as well as large-scale scenario forecast and simulation infrastructures such as Destination Earth Data Lake (DEDL, Puechmaille et al. 2025) and the Green Deal Data Space (Penninga et al. 2021) are currently implemented. Setting up these data spaces requires the consolidation and harmonization of vast amounts of data, among them data from long-term biodiversity monitoring (e.g. eDNA, Abarenkov et al. 2023), near real-time data captured by IoT devices (e.g. camera traps, Grieb et al. (2025)) and large-scale Earth observation data (e.g. ERA5 global reanalysis, Hersbach et al. (2020)).

Key tools and research methodologies for integration of such data have been developed in the Destination Earth-linked Biodiversity Digital Twin project (BioDT). Biodiversity digital twins provide digital replicas of biodiversity patterns and processes (Khan et al. 2025), for FAIR-compliant reuse and cross-platform portability, they are packaged in BioDT using the RO-Crate specification. Resulting datasets as well as computational

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workflows are bundled as digital objects and annotated with rich machine-interpretable metadata using schema.org and its extensions Bioschemas and Croissant (high-level metadata specification supporting AI-Readiness, Bolleman et al. 2025).

The workflow.earth pilot was developed to migrate and functionally integrate BioDT's digital twin for crop wild relatives (BioDT CWR) into DEDL. BioDT CWR is designed to identify genetic resources in crop wild relatives (CWR) and aid in creating strategies to mitigate food-related crises linked to climate change (Chala et al. 2024). CWR are crucial sources of untapped genetic diversity, offering greater adaptability to extreme weather events such as droughts, cold waves, and heavy precipitation. They are therefore of particular importance to ensure food security with regard to Sustainable Development Goals (notably Goal 2 “End hunger, achieve food security and improved nutrition and promote sustainable agriculture”, United Nations 2023).

Major objectives for workflow.earth are

1. to enhance visibility and long-term availability of the BioDT CWR,
2. to improve its prediction capabilities using DEDL’s near data processing services, and
3. to facilitate (in perspective) the orchestrated interplay with other digital twins such as the Climate Change Adaptation DT (Weiland et al. 2024).

On top of RO-Crate, workflow.earth employs FAIR Signposting to add machine-interpretable links to human-readable digital objects using link relation types (RFC8288, Fig. 1) to present the web topology of a resource (Soiland-Reyes et al. 2024).

In this presentation, we will demonstrate the deployment of agrobiodiversity workflows in DEDL using workflow.earth and the publication of model and results as webby FDOs.

Keywords

climate change, crop wild relatives, SDG, Destination Earth, data lake, Earth observation, RO-Crate, FAIR, signposting, species distribution model

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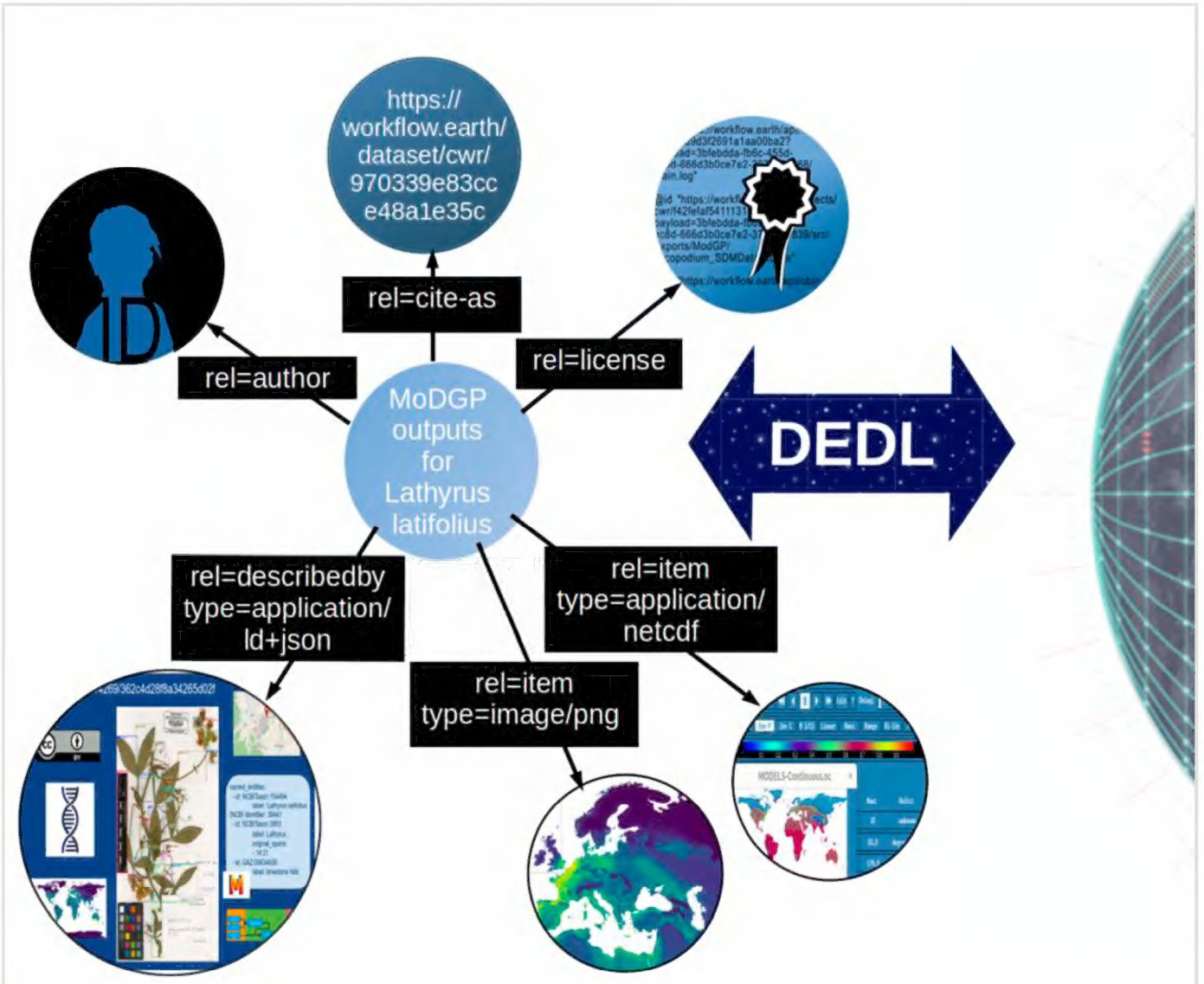

Figure 1.

FAIR Signposting in workflow.earth using link relation types to indicate resources and attribution of a CWR species distribution model, i.a. "describedBy" to link to the RO-Crate describing the resource, "license" to link to a machine-interpretable license and "author" to link of the author's ORCID or Wikidata Person ID (all graphics by Myriam Ries/weltalle and Claus Weiland under CC-BY-4.0).

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Conflicts of interest

The authors have declared that no competing interests exist.

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